ME 419: Heat Transfer Fall 2021

Instructor:
Professor Srikanth Gopalan
Department of Mechanical Engineering
15 St.Mary's St, Rm 144

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Course web page: Blackboard

Classroom and Laboratory COVID Protocol: Face masks required at all times
GST: Garam Lee, garamlee@bu.edu

Course schedule:
Lectures: MW 2:30 – 4:15 PM (SAR 104)
Discussions B1: TBD, B2: EPC 204 Thu 5:00-5:50 PM
Instructor Office hours: Mon 10:30 AM -12:30 PM (15 St.Mary's St, Rm 144); if you have class during this time, but would like to meet, please email instructor to find a suitable time.
GST Office hours: Tue, Fri 2-3 PM EMA 205
Labs: 2 labs – locations TBA

Textbook: Fundamentals of Heat Mass Transfer 8e by Bergman et al., Wiley Publishing
ISBN: 9781119447658

Prerequisites:
ME 303 & ME 304 or equivalent. Familiarity with engineering mathematics with partial differential equations.

Course description:
Understanding and controlling heat (thermal energy) is critical for many engineering systems. This course covers the fundamentals of heat transfer from a macroscopic perspective, with an emphasis on modeling and simplifying approximations to solve real-world engineering problems. Examples are taken from a number of fields including manufacturing, electronics, consumer products, and energy systems.

Policy on collaboration:
Collaboration is encouraged on homework and labs, however students should turn in their own work in their own words. No collaboration is permitted on exams.

Grading:

Homework (5%):	Problem sets assigned roughly every week
Lab reports (20%):	Two laboratory exercises
Exam I (20%):	Closed-book exams; formula sheets will be provided
Exam II (25%):	Closed-book exams; formula sheets will be provided
Final Exam (25%):	Closed book; formula sheet will be provided.
Participation (5%):	Will be evaluated on overall participation in class and discussion

Homework:
Homework assignments will be announced in class and tentative dates are on this syllabus available on the course webpage. Homework submission is on Gradescope. The deadline is 11.59 PM on the day it is due. No late homeworks will be accepted.

Lab exercises:
There will be two lab exercises for this course. Sign-up sheets will be posted in advance of the labs. The experiments will be done in groups, but lab reports will be done individually.

- Reports are limited to a **strict 4 page length limit**. *pages beyond 4 will not be graded*
- Cover pages are strongly discouraged, as they will count toward the 4-page limit
- Fonts must be 11 pt or larger, margins must be 1" or larger
- Individual laboratory reports are due by 4 PM in class or to the ME office (110 Cummington Mall, Rm 101).
- Email submission is acceptable in cases of emergency; email both Prof. Gopalan and the GST.
- Late labs will be accepted for grading for up to week late with a 10% late penalty provided that the student is in correspondence with Prof. Gopalan. Labs will only be accepted beyond this point with prior approval by Prof. Gopalan and will be subject to greater late penalties.
- Students are expected to physically complete the laboratory exercise. If a student fails to sign up or misses their lab timeslot, he or she should reach out to the lab GST immediately to see if there might be another open slot. If not, the student can receive lab data to complete the report, and the report will be subject to a 25% penalty.

Exams:
Each exam will take place over an entire class period. Each exam will cover a block of lectures as noted in the schedule. The Final Exam is cumulative.

- Missing an exam due to vacation is not excusable. Arrangements will be made on a case-by-case basis for documented emergencies or University conflicts.
- Students requiring additional time to complete examinations must supply proper documentation from the Office of Disability Services at ***least 3 days in advance*** of an examination to the instructor so suitable arrangements can be made.

Boston University Academic Conduct Code*:* Honesty is a core value of Boston University. Any violations of BU academic honesty and integrity standards ***will be pursued*** through appropriate University channels. This includes, but is not limited to: cheating, plagiarism and misrepresentation. If you have any questions as to what constitutes an honor code violation, please ask. ***Ignorance is not an excuse for cheating***. You may access the BU Academic Conduct Code at:
http://www.bu.edu/academics/policies/academic-conduct-code/

Lecture by topic: We will cover the following topics around these given dates.

Lecture	Date	Topic	Suggested Reading	Due
1	9/8	Introduction to Heat Transfer	1	
2	9/13	Intro to conduction – Heat Equation	2	
3	9/15	Solving the Heat Equation: Boundary Conditions	Chp 2.4, 3.1-3.3	
4	9/20	1D Steady Conduction: Thermal Circuits	2.3-.5, 3.1-.5	PS #1
5	9/22	Fins & Finned Surfaces	3.5, 3.10	
6	9/27	2D & 3D Steady Conduction	4.1-4.3	PS #2
7	9/29	Transient Conduction: Lumped Systems	5.1-5.3	
8	10/4	Unsteady Conduction (Slabs, spheres, cylinders) *Lab 1 Occurs During This Week*	5.1-5.6	PS #3
9	10/6	Semi-infinite Bodies	5.7-5.8	
10	10/12 (Tue)	2D & 3D Transient Conduction, Conduction Review		PS #4
11	10/13	**Exam 1 – [Lect. 1-9]**		
12	10/18	Intro to Convection: Fluids & Mass Transfer	6.1-6.3	Lab #1
13	10/20	Boundary Layers & Dimensionless Numbers	Chapter 6	
14	10/25	External Forced Convection by Correlations	7.1-7.3	PS #5
15	10/27	Applications of External Forced Convection	7.4-7.9	
16	11/1	Internal Forced Convection	8.1-8.5	PS #6
17	11/3	Applications of Internal Forced Convection *Lab 2 Occurs During This Week*	Chapter 8	
18	11/8	Natural Convection	Chapter 9	PS #7
19	11/10	Boiling & Condensation	10.1-10.5	
20	11/15	Heat Exchangers: LMTD Method	11.1-11.3	PS #8
21	11/17	**Exam 2 – [Lect. 10-19]**		
22	11/22	Heat Exchangers: Effectiveness-NTU Method	11.4-11.6	Lab #2
23	11/29	Radiation	Ch. 12-13	PS #9
24	12/1	The Three Modes of Heat Transfer in Practice	Ch. 1-13	
25	12/6	The Mass Transfer Analogy: Fick's Law	14.1-14.5	
26	12/8	Review		PS #10
27		**Final exam TBD**		